

T04D07 – HL Bonding Review

Name.....

Topic 04 - Bonding8. What is the best description of the carbon-oxygen bond lengths in CO_3^{2-} ?

- A. One short and two long bonds
- B. One long and two short bonds
- C. Three bonds of the same length
- D. Three bonds of different lengths

9. Which molecule is polar?

- A. CO_2
- B. PF_3
- C. CH_4
- D. BF_3

10. How many sigma (σ) and pi (π) bonds are present in the structure of HCN?

	σ	π
A.	1	3
B.	2	3
C.	2	2
D.	3	1

11. What are responsible for the high electrical conductivity of metals?

- A. Delocalized positive ions
- B. Delocalized valence electrons
- C. Delocalized atoms
- D. Delocalized negative ions

12. Which compound contains **both** ionic and covalent bonds?

- A. MgCl_2
- B. HCl
- C. H_2CO
- D. NH_4Cl

13. When C_2H_4 , C_2H_2 and C_2H_6 are arranged in order of **increasing** C–C bond length, what is the correct order?

- A. C_2H_6 , C_2H_2 , C_2H_4
- B. C_2H_4 , C_2H_2 , C_2H_6
- C. C_2H_2 , C_2H_4 , C_2H_6
- D. C_2H_4 , C_2H_6 , C_2H_2

14. Which combination of $\Delta H_{\text{vaporization}}$ and boiling point is the result of strong intermolecular forces?

	$\Delta H_{\text{vaporization}}$	Boiling Point
A.	large	high
B.	large	low
C.	small	low
D.	small	high

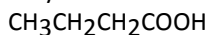
15. Which allotropes contain carbon atoms with sp^2 hybridization?

- I. Diamond
 - II. Graphite
 - III. C_{60} fullerene
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

16. What is the formula of the compound formed when aluminum reacts with oxygen?

- A. Al_3O_2
- B. Al_2O_3
- C. AlO_2
- D. AlO_3

17. Identify the types of hybridization shown by the carbon atoms in the molecule



I. sp

II. sp^2

III. sp^3

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

18. Which statement is true for compounds containing only covalent bonds?

- A. They are held together by electrostatic forces of attraction between oppositely charged ions.
- B. They are made up of metal elements only.
- C. They are made up of a metal from the far left of the periodic table and a non-metal from the far right of the periodic table.
- D. They are made up of non-metal elements only.

19. Which compound has the highest boiling point?

- A. $\text{CH}_3\text{CH}_2\text{CH}_3$
- B. $\text{CH}_3\text{CH}_2\text{OH}$
- C. CH_3OCH_3
- D. CH_3CHO

20. What type of solid materials are typically hard, have high melting points and poor electrical conductivities?

- I. Ionic
- II. Metallic
- III. Covalent-network

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

21. (a) Draw the Lewis structures for the compounds XeF_4 , PF_5 and BF_4^- .

(3)

(b) Use the valence shell electron pair repulsion (VSEPR) theory to predict the shapes of the three compounds in (a). State and explain the bond angles in each of the three compounds.

(3)

(Total 6 marks)

22. (i) Apply the VSEPR theory to deduce the shape of NO_2^- , ICl_5 and SF_4 . For each species, draw the Lewis (electron dot) structure, name the shape, and state the value of the bond angle(s).

(9)

- (ii) Discuss the bond angle(s) in SF₄.

(1)

- (iii) Explain the hybridization involved in the C₂H₄ molecule.

(4)

- (iv) State the hybridization involved in the NO₂⁻ ion and comment on the nitrogen-oxygen bond distances.

(2)

- (v) Using Table 7 of the Data Booklet, predict and explain which of the bonds O-H, O-N or N-H would be most polar.

(2)

(Total 18 marks)

23. (a) (i) State the meaning of the term *hybridization*.

(1)

- (ii) State the type of hybridization around the carbon atoms in C₆₀ fullerene, diamond and graphite.

(3)

- (iii) Explain why graphite and C₆₀ fullerene can conduct electricity.

(2)

- (b) (i) Compare how atomic orbitals overlap in the formation of sigma (σ) and pi (π) bonds.

(2)

- (ii) State the number of sigma bonds and pi bonds in H₂CC(CH₃)CHCH₂.

(2)

(Total 10 marks)